

DOs and DON'Ts for PSSA Math Test Prep

Network Connections
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Not on the Test

Morning Edition, January 1, 2007 · For students out there who may be stressed out, here's a lullaby for our times. "Not on the Test" was written by John Forster and Tom Chapin. It is performed by Tom Chapin. (<http://www.npr.org/templates/story/story.php?storyId=6705929>)

Go on to sleep now,
Third grader of mine.
The test is tomorrow,
But you'll do just fine.
It's reading and math.
Forget all the rest.
You don't need to know
What is not on the test.



Each box that you mark
On each test that you take
Remember your teachers.
Their jobs are at stake.
Your score is their score,
But don't get all stressed.
They'd never teach anything
Not on the test.

Sleep, sleep -- and as you progress
You'll learn there's a lot
That is not on the test.

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Debate is skill that is useful to
know
Unless you're in Congress or talk
radio
Where shouting and spouting
and spewing are blessed
'Cause rational discourse' was
not on the test.

Thinking's important ...
It's good to know how.
And someday you'll learn to
But someday's not now.
Go on to sleep now.
You need your rest.
Don't think about thinking
It's not on the test.

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Today's Session

- Sharing Current Practices
- What Does It Mean to be Proficient?
- Managing Time
- Standards, Anchors, and Eligible Content
- Acquisition and Retention of Mathematical Knowledge
- Advocated Test Prep Strategies

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Sharing Current Practices

- At your tables, discuss your current practices and strategies for PSSA Math test preparation.
- Choose a representative to report out with the whole group.

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Current Practices

- How are your current practices working for you?
 - Are you making AYP for your district?
 - Are you making AYP at each school building?
 - Are you making AYP with all sub-groups?
 - How are you making AYP?
- Will your current practices continue to work for you with 2008 targets? 2010? Beyond?

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Stipulation

There is NO SILVER BULLET for PSSA Math test preparation. If one existed, there would be no need for this session.

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Mathematical Proficiency

- By the numbers: What did it take to be proficient on the 2006 PSSA Math test?

Grade	4	5	6	7	8	11
Raw Score	36/66	40/66	37/66	34/66	39/66	45/66
% Score	54.5%	60.6%	56.1%	51.5%	59.1%	68.2%
% Need to Know	40%	48%	42%	36%	46%	58%

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Mathematical Proficiency

- Implications
 - Understanding should be emphasized over "coverage."
 - Our traditional notion of proficient – a grade of C or higher (70% or greater) does not align with PSSA.

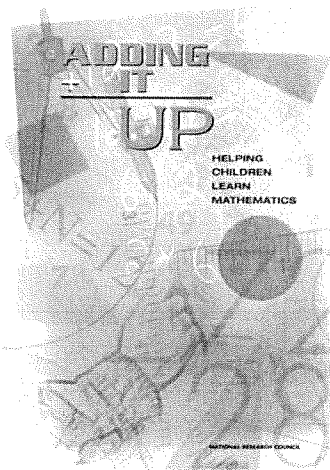
The greatest enemy to understanding is coverage.

-Howard Gardner

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Mathematical Proficiency



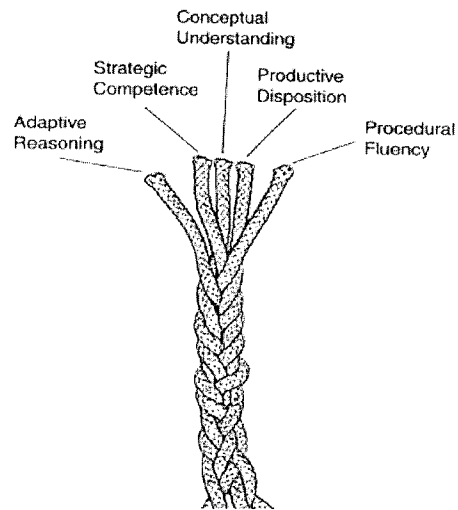
Adding It Up: Helping
Children Learn Mathematics

National Research Council

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The Strands of Mathematical Proficiency



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The Strands of Mathematical Proficiency

Conceptual understanding -- comprehension of mathematical concepts, operations, and relations

- More than facts and methods
- Understand importance of ideas and useful contexts
- Organize knowledge into a coherent whole
- Different representations
- Connections
- Supports retention

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The Strands of Mathematical Proficiency

Procedural fluency -- skill in carrying out procedures flexibly, accurately, efficiently, and appropriately

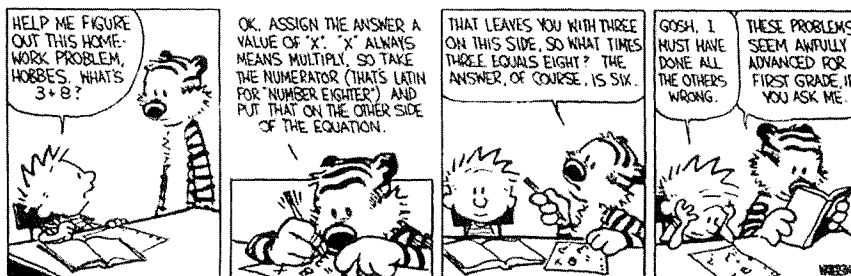
- More than knowing procedures
- Involves knowing when to use procedures
- Choosing the right tool
- Efficiency and accuracy
- Requires learning with understanding



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The Strands of Mathematical Proficiency

A counter-example of procedural fluency



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The Strands of Mathematical Proficiency

Strategic competence-- ability to formulate, represent, and solve mathematical problems

- Similar to problem solving
- Involves problem formulation as well as solving
- Representing problem situations
- Building mental models of problems
- Generate mathematical representations capturing core mathematical elements (*gasoline problem*)
- Flexibility (*comparing prices*)
- Non-routine problems

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The Strands of Mathematical Proficiency

Adaptive reasoning -- capacity for logical thought, reflection, explanation, and justification

- Explanation
- Justification
- Intuitive and inductive reasoning
- Proof

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The Strands of Mathematical Proficiency

Productive disposition -- habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

- Develops with other strands
- Must believe math is understandable, not arbitrary
- Must believe that math can be learned and used
- Teacher plays a critical role to promote productive disposition

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Properties of Mathematical Proficiency

- **The Strands of Proficiency are Interwoven**
- **Proficiency is Not All or Nothing**
- **Proficiency Develops Over Time**

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Strategic Competence

At ARCO, gas sells for \$1.13 per gallon. This is 5 cents less per gallon than gas at Chevron. How much does 5 gallons of gas cost at Chevron?

[\(back\)](#)

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Strategic Competence

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Strategic Competence

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[\(back\)](#)

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Strategic Competence

Choose between:

1. 4 oz. can of peanuts for 45¢
or 10 oz. can for 90¢
2. 14 oz. jar of sauce for 79¢
or 18 oz. jar for 81¢
3. 3 oz. bag of sunflower seeds
for 33¢ or 4 oz. bag for 44¢

[\(back\)](#)

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Monitoring Proficiency

- Formative Classroom Assessments
- Student data from formal assessments
- 4Sight

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Monitoring Proficiency

3. **Pennsylvania Assessment Anchor:** Identify and/or use properties of quadrilaterals (e.g., parallel sides, diagonals, bisectors, congruent sides/angles and supplementary angles). (M11.C.1.2.2)
Pennsylvania Standard: Identify, name, draw and list all properties of squares, cubes, pyramids, parallelograms, quadrilaterals, trapezoids, polygons, rectangles, rhombi, circles, spheres, triangles, prisms and cylinders. (2.9.8.D)

Which of the following is **not** a property of every parallelogram?

- A The measure of each angle is 90° .
- B The opposite sides are equal in length.
- C The opposite sides are parallel.
- D The sum of the interior angles equals 360° .

THEY GOT IT!

- A Some parallelograms (rhombi) have angles that do not measure 90° .

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Monitoring Proficiency

5. **Pennsylvania Assessment Anchor:** Express numbers and/or simplify expressions using scientific notation (including numbers less than 1). (M11.A.1.1.2)
Pennsylvania Standard: Simplify numerical expressions involving exponents, scientific notation and using order of operations. (2.1.8.B)

The wingspan of a gnat, in meters, is 5×10^{-3} . This expression is the same as which of the following numbers?

- A 0.0005
 → B 0.005
 C 500
 D 5,000

WHAT WERE THEY THINKING?

- A used 3 decimal zeros instead of 3 decimal places
 B miscalculated 5×10^{-3} using 3 places
 C calculated 5×10^3

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Monitoring Proficiency

4. **Pennsylvania Assessment Anchor:** Find probabilities for independent, dependent or compound events and represent as a fraction, decimal or percent. (M11.E.3.1.1)
Pennsylvania Standard: Solve problems involving independent simple and compound events. (2.7.11.E)

A basket contains four white shells, seven black shells and two pink shells. What is the probability that a shell randomly selected from the basket will be a pink shell?

- A 7.7%
 → B 15.4%
 C 18.2%
 D 50.0%

THEY GOT IT!

B found the probability of the event $\left(\frac{2 \text{ pink shells}}{13 \text{ total shells}} \right)$ divided to express as a percentage.

WHAT WERE THEY THINKING?

- A did not include all pink shells in the basket. $\frac{1 \text{ pink shell}}{13 \text{ total shells}}$
 B did not include the pink shells when determining the total number of shells. $\frac{2 \text{ pink shells}}{11 \text{ non-pink shells}}$
 C did not include the non-pink shells. $\frac{1 \text{ pink shell}}{2 \text{ pink shells}}$

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Time Management

- Make every minute count
 - Is a 5 minute PSSA warm-up making the impact on student achievement you desire?
 - 5 minutes x 180 days = 15 hours of instructional time
 - Make routines non-intrusive to student learning time.
 - Time burglars
 - Homework (going over/starting at end of class)
 - Classroom management issues.

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Time Management

- You have more than September to March to prepare for PSSA
 - Think of the PSSA year as March to March
 - Grade levels for anchors are when they are assessed, not when they must be learned.
- Every day counts including the first day of school, the last day of school, the day before a holiday break, and the day with a shortened class schedule.

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Standards, Anchors, and Eligible Content (Oh, my!!)

- Each grade level tested (3 – 8) has approximately 40 pieces of eligible content. Grade 11 has approximately 60 pieces of eligible content.
- How many instructional days do you have per year? Is there adequate time to teach the anchors and eligible content deeply?

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Standards, Anchors, and Eligible Content (Oh, my!!)

- PSSA has 54 multiple choice questions (1 point each) and 3 open-ended questions (4 points each)
- Multiple choice items are based on eligible content.
- Open-ended items are based on assessment anchors.

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Standards, Anchors, and Eligible Content (Oh, my!!)

- Chapter 4 regulations require us to teach to the Pennsylvania Academic Standards.
- Assessment anchors simply clarify which standards are assessed on the PSSA, and do not replace the standards. All teachers are still required to teach to all of the standards.
- Eligible content is the assessment limit for multiple choice items. Not all of the eligible content is assessed on the PSSA, but it shows the range of knowledge from which the test is designed.

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Standards, Anchors, and Eligible Content (Oh, my!!)

- What does PSSA math preparation around standards, anchors, and eligible content entail?
 - Align curriculum with the standards!
 - Implement the curriculum to promote deep conceptual understanding to teach for transfer.
 - Allow for learning to take place over time.
 - Do not teach anchors as discrete content items.

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Acquisition and Retention

- Learning must be structured and connected.
 - Build on what students know and structure tasks so that prior knowledge is incorporated into new learning
 - Connections may be within mathematics, to other content areas, or to "real-life" problem solving
- Retention requires both practice and connections.
 - Massed practice vs. distributed practice
 - Connections help us make sense and remember

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Acquisition and Retention

- **Transfer of Learning**
 - Skills and knowledge must be extended beyond the narrow contexts in which they are initially learned.
 - It is essential for the learner to develop a sense of *when* what has been learned can be used – the conditions of application.
 - Learning must be guided by generalized principles in order to be widely applicable. Knowledge learned at the level of rote memory rarely transfers; transfer most likely occurs when the learner knows and understands underlying principles that can be applied to problems in new contexts.
 - Learners are helped in their independent learning attempts if they have conceptual knowledge.

Executive Summary -- How People Learn:
Brain, Mind, Experience, and School

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Acquisition and Retention

- **Acquisition without retention is a problem.**

- Students may not retain information long enough to perform adequately when PSSA is administered
- Re-learning in subsequent years takes time from new learning
- Cumulative effect results in declining scores as grade levels increase

Executive Summary -- How People Learn:
Brain, Mind, Experience, and School

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Acquisition and Retention

- Distribute practice over time. This does not mean "spiraling" or "review."
- Space practice out. Longer intervals between practice lead to longer-term retention.
- Practice in a variety of contexts.
- For the best, most flexible recall, learn in a variety of different situations.

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Test Prep Strategies

- Improve Teaching
 - Teacher pedagogical content knowledge
 - Inquiry-based instruction
 - Teaching for understanding rather than coverage
 - Residue vs. mastery model

(next)

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Pedagogical Content Knowledge

"Effective teachers need 'pedagogical content knowledge' – knowledge about how to teach in particular disciplines, which is different from knowledge or general teaching methods."

"The misconception is that teaching consists only of a set of general methods, that a good teacher can teach any subject, and that content knowledge alone is sufficient."

Executive Summary -- How People Learn:
Brain, Mind, Experience, and School

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Pedagogical Content Knowledge: How Important Is It?

"Teachers' content knowledge for teaching mathematics was a significant predictor of student gains."

"This suggests that knowledgeable teachers can positively and substantially affect students' learning of mathematics, and the size of this effect...is in league with the effects of student background characteristics."

Hill, Rowan, and Ball, *Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement*, American Educational Research Journal, Summer 2005

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Pedagogical Content Knowledge: How Important Is It?

"...the achievement gains between having a 25th percentile teacher (a not so effective teacher) and a 75th percentile teacher (an effective teacher) is ... almost half a standard deviation (0.48) in math. Similarly, the difference in achievement gains between having a 50th percentile teacher (an average teacher) and a 90th percentile teacher (a very effective teacher) is ... somewhat smaller than half a standard deviation (0.46) in mathematics."

(back)

Nye, Barbara, Konstanapoulis, and Hedges, *How Large Are Teacher Effects*, Educational Evaluation and Policy Analysis, Fall 2004

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Test Prep Strategies

- Evaluate the nature of student learning
 - Rote learning, procedural learning, conceptual learning
 - Teaching for understanding over time as opposed to teaching discrete topics for quick mastery
 - Learning that is durable as opposed to learning that is fragile

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Test Prep Strategies

- Support for Struggling Students
 - Keep students in their regular classes
 - Homework clinics
 - Study groups
 - Extra support classes based on filling gaps in understanding

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Test Prep Strategies

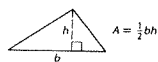
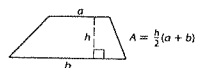
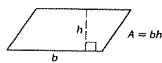
• Tools

- Calculator usage
- Student-constructed aids (e.g. 100 chart)
- Familiarity with the formula sheets (example)
- Familiarity with rubrics (next)

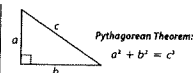
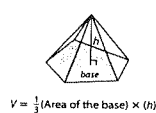
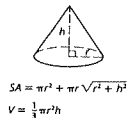
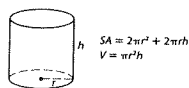
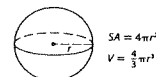
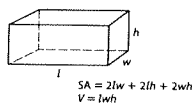
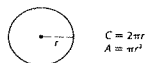
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Test Prep Strategies



(back)



Permutations: $P(n, r) = \frac{n!}{(n-r)!}$

Combinations: $C(n, r) = \frac{n!}{r!(n-r)!}$

Distance Formula:
 $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

Point-Slope Formula:
 $(y - y_1) = m(x - x_1)$

Slope Intercept Formula:
 $y = mx + b$

Standard Equation of a Line:
 $Ax + By = C$



PSSA Preparation

Every minute of every class is
PSSA preparation. It is
embedded in good instruction
with an eye on student learning.

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Thank You

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